CLAIMS

1. A bistatic radar system comprising:

a transmitter for directing electromagnetic energy toward a target, said transmitter having a velocity vector $\mathbf{v}_T$;

a receiver adapted to receive said electromagnetic energy reflected from said target, said receiver having a velocity vector $\mathbf{v}_R$; and

means for optimizing a parameter of said transmitter and/or said receiver such that a directional derivative J of a bistatic Doppler field along an isorange contour is near a desired value.

2. The invention of Claim 1 wherein said parameter includes the transmitter velocity vector $\mathbf{v}_T$.

3. The invention of Claim 1 wherein said parameter includes the receiver velocity vector $\mathbf{v}_R$.

4. The invention of Claim 1 wherein said parameter includes the receiver azimuth flight direction θ.

5. The invention of Claim 1 wherein said parameter includes the speed of the receiver.

6. The invention of Claim 1 wherein said desired value is the minimal absolute value of the directional derivative.

7. The invention of Claim 1 wherein said desired value is the maximum absolute value of the directional derivative.

8. The invention of Claim 1 wherein said desired value is a range of values of the directional derivative.

9. The invention of Claim 1 wherein said directional derivative J is computed by taking the dot product of the bistatic Doppler gradient vector $\nabla \mathrm{f_D}$ and the unit tangent vector to the isorange contour at the target point $\vec{\mathbf{T}}_{\mathbf{u}}$.

10. The invention of Claim 9 wherein said the Doppler gradient vector $\nabla \mathrm{f_D}$ is computed from the equation:

$$\nabla \mathbf{f_D} = \frac{1}{\lambda}\left\{\frac{\mathbf{v_T} - (\mathbf{v_T} . \overrightarrow{\mathbf{TP_u}})\overrightarrow{\mathbf{TP_u}}}{R_1} + \frac{\mathbf{v_R} - (\mathbf{v_R} . \overrightarrow{\mathbf{RP_u}})\overrightarrow{\mathbf{RP_u}}}{R_2}\right\},$$

where $\overrightarrow{\mathbf{TP}}_{\mathbf{u}}$ and $\overrightarrow{\mathbf{RP}}_{\mathbf{u}}$ are the unit line-of-sight vectors from the transmitter and receiver to the target point, respectively, R_1 and R_2 are the distances from the transmitter and receiver to the target point, respectively, and λ is the wavelength of the electromagnetic energy.

11. The invention of Claim 9 wherein said unit tangent vector $\vec{\mathbf{T}}_{\mathbf{u}}$ is computed by forming the equation of the isorange contour, differentiating to yield the slope, and normalizing.

12. The invention of Claim 11 wherein said isorange contour is an ellipse whose equation is in the form of $ax^2 + by^2 + 2cxy + dx + ey + f = 0$, where *a, b, c, d, e*, and *f* are coefficients obtained from the given transmitter-receiver-target geometry.

13. The invention of Claim 1 wherein said means for optimizing includes explicitly computing the values of said directional derivative for varying values of said parameter(s).

14. A bistatic radar system comprising:

a transmitter for directing electromagnetic energy toward a target, said transmitter having a velocity vector $\mathbf{v}_T$;

a receiver adapted to receive said electromagnetic energy reflected from said target, said receiver having a velocity vector $\mathbf{v}_R$;

a processor for computing an optimal motion of said transmitter and/or said receiver such that a directional derivative J of a bistatic Doppler field along an isorange contour is near a desired value; and

a system for controlling the motion of said transmitter and/or said receiver based on said optimal motion.

15. A method for controlling the clutter Doppler spread of a bistatic radar system including the steps of:

computing the directional derivative J of the bistatic Doppler field along the isorange contour as a function of a parameter or parameters to be optimized and

determining the value or values of said parameter(s) which yield a desired directional derivative.

16. The invention of Claim 15 wherein said desired directional derivative is the minimal absolute value of the directional derivative for minimizing the clutter Doppler spread.

17. The invention of Claim 15 wherein said desired directional derivative is the maximum absolute value of the directional derivative for maximizing the clutter Doppler spread.

18. The invention of Claim 15 wherein said desired directional derivative is a range of values of the directional derivative.

19. The invention of Claim 15 wherein said parameter includes a transmitter velocity vector $\mathbf{v}_T$.

20. The invention of Claim 15 wherein said parameter includes a receiver velocity vector $\mathbf{v}_R$.

21. The invention of Claim 15 wherein said parameter includes a receiver azimuth flight direction θ.

22. The invention of Claim 15 wherein said parameter includes a speed of the receiver.

23. The invention of Claim 15 wherein said directional derivative J is computed by taking the vector dot product of the bistatic Doppler gradient vector ∇f_D and the unit tangent vector to the isorange contour at the target point $\vec{\mathbf{T}}_{\mathbf{u}}$.

24. The invention of Claim 23 wherein said the Doppler gradient vector ∇f_D is computed from the equation:

$$\nabla \mathbf{f}_{\mathbf{D}} = \frac{1}{\lambda}\left\{\frac{\mathbf{v}_{\mathbf{T}} - (\mathbf{v}_{\mathbf{T}}.\overrightarrow{\mathbf{TP}_{\mathbf{u}}})\overrightarrow{\mathbf{TP}_{\mathbf{u}}}}{R_1} + \frac{\mathbf{v}_{\mathbf{R}} - (\mathbf{v}_{\mathbf{R}}.\overrightarrow{\mathbf{RP}_{\mathbf{u}}})\overrightarrow{\mathbf{RP}_{\mathbf{u}}}}{R_2}\right\},$$

where $\overrightarrow{\mathbf{TP}}_{\mathbf{u}}$ and $\overrightarrow{\mathbf{RP}}_{\mathbf{u}}$ are the unit line-of-sight vectors from the transmitter and receiver to the target point, respectively, R_1 and R_2 are the distances from the transmitter and receiver to the target point, respectively, and λ is the wavelength of the electromagnetic energy.

25. The invention of Claim 23 wherein said unit tangent vector $\vec{\mathbf{T}}_{\mathbf{u}}$ is computed by forming the equation of the isorange contour, differentiating to yield the slope, and normalizing.

26. The invention of Claim 25 wherein said isorange contour is an ellipse whose equation is in the form of $ax^2 + by^2 + 2cxy + dx + ey + f = 0$, where *a, b, c, d, e*, and *f* are coefficients obtained from the given transmitter-receiver-target geometry.